

[0057] Suitable ionic reagents include aqueous solutions of ammonium hydroxide, ammonium chloride, ammonium bromide, ammonium nitrate, potassium hydroxide, potassium chloride, potassium bromide or potassium nitrate.

[0058] The ionic reagent functions to increase the solubility of proteins in the silk by increasing the charge density on the protein ('salting in').

[0059] According to a second aspect of the invention, there is provided a method of preparing a regenerated fibroin solution, the method comprising steps of:

[0060] treating silk or silk cocoons with an ionic reagent comprising an aqueous solution of monovalent cations and monovalent anions, wherein the cations are selected from any one or more of the following: ammonium, potassium, rubidium, and the anions are selected from one or more of the following: hydroxide, chloride, bromide, nitrate; and

[0061] degumming the treated silk or silk cocoons; or alternatively

[0062] degumming silk or silk cocoons; and

[0063] treating the degummed silk or silk cocoons with an ionic reagent comprising an aqueous solution of monovalent cations and monovalent anions, wherein the cations are selected from any one or more of the following: ammonium, potassium, rubidium, and the anions are selected from one or more of the following: hydroxide, chloride, bromide, nitrate.

[0064] It will be appreciated that the preferred features described in relation to the first aspect of the invention apply to the second aspect of the invention.

[0065] The methods may comprise a subsequent step (c) of dissolving the degummed silk or silk cocoons in a chaotropic agent.

[0066] The step of dissolving the silk or silk cocoons may be performed under any one of the following conditions, or any combination of the following conditions:

[0067] at a temperature of less than 60° C.;

[0068] with a concentration of chaotropic agent up to 9.5M; and

[0069] for a period of time of less than 24 hours.

[0070] The degummed silk or silk cocoons may be dissolved in the chaotropic agent at any suitable temperature, for example, within a temperature range of approximately 10° C. to approximately 60° C. For instance, the degummed silk or silk cocoons are dissolved in the chaotropic agent within a temperature range of approximately 15° C. to approximately 40° C. By way of example, good results have been achieved by dissolving the degummed silk or silk cocoons in the chaotropic agent at a temperature of approximately 37° C.

[0071] The degummed silk or silk cocoons may be dissolved in the chaotropic agent at any suitable concentration, for example, in a concentration of the chaotropic agent of 9.3M. For instance, the degummed silk or silk cocoons may be dissolved in a concentration of the chaotropic agent of less than 9M. The degummed silk or silk cocoons may be dissolved in a concentration of the chaotropic agent within the concentration range of approximately 7M to approximately 9M.

[0072] The degummed silk or silk cocoons may be dissolved in the chaotropic agent for any suitable time period, for example, a time period of less than 24 hours.

[0073] In another aspect of the invention, there is provided a method of preparing a regenerated fibroin solution, the method comprising the steps of:

[0074] (a) treating silk or silk cocoons with an ionic reagent comprising an aqueous solution of monovalent cations and monovalent anions, the cations and anions having ionic radii of at least 1.05 Angstroms and a Jones-Dole B coefficient of between -0.001 and -0.05 at 25° C.; and

[0075] (b) subsequently dissolving the silk or silk cocoons in a chaotropic agent, wherein the step of dissolving the silk or silk cocoons is performed under any one of the following conditions, or any combination of the following conditions:

[0076] at a temperature of less than 60° C.;

[0077] with a concentration of chaotropic agent less than 9M; and

[0078] for a period of time of less than 24 hours.

[0079] The method may comprise a further step of degumming the silk or silk cocoons, preferably before dissolving the silk or silk cocoons in the chaotropic agent.

[0080] The degumming step may be performed before step (a). Alternatively, the degumming step may be performed after step (a). Alternatively still, the degumming step may be performed at the same time as step (a).

[0081] The degummed silk or silk cocoons may be dissolved in the chaotropic agent within a temperature range of approximately 10° C. to approximately 60° C. Preferably, the degummed silk or silk cocoons are dissolved in the chaotropic agent within a temperature range of approximately 15° C. to approximately 40° C. By way of example, particularly good results have been achieved where the degummed silk or silk cocoons are dissolved in the chaotropic agent at a temperature of approximately 37° C.

[0082] Preferably, the degummed silk or silk cocoons are dissolved in the chaotropic agent at a concentration of chaotropic agent within the range of approximately 6M to 9M, for example, approximately 7M.

[0083] Preferably, the degummed silk or silk cocoons are dissolved in the chaotropic agent for a period of time of less than 12 hours. Most preferably, the degummed silk or silk cocoons are dissolved in the chaotropic agent for a period of time of less than 4 hours.

[0084] The chaotropic agent may comprise one suitable chaotropic agent or a combination of suitable chaotropic agents. Suitable chaotropic agents include lithium bromide, lithium thiocyanate, or guanidinium thiocyanate. A preferred the chaotropic agent comprises an aqueous lithium bromide solution.

[0085] In one preferred embodiment, the step of dissolving may be performed at a temperature of approximately 60° C. with a concentration of approximately 9.3 M lithium bromide solution for approximately 2 hours. Alternatively, the step of dissolving may be performed at a temperature of approximately 60° C. with a concentration of approximately 7 M lithium bromide solution for a period of approximately 6 hours. As a further alternative, the step of dissolving may be performed at a temperature of approximately 20° C. with a concentration of approximately 9.3 M lithium bromide solution for a period of approximately 24 hours. Most preferably the step of dissolving is performed at a temperature of approximately 37° C. with a concentration of approximately 9.3M lithium bromide solution for a period of approximately 4 hours.

[0086] Degumming the silk or silk cocoons may comprise the selective removal of sericin from the silk or silk cocoons and may use a proteolytic enzyme which cleaves sericin, but